

A Commitment to the Future:

Precollegiate Science Educational Outreach

By

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THERE IS AN EVER-WIDENING GAP BETWEEN the panorama of modern research and the glimpses of science that teachers can present easily in a classroom. This is due, in part, to advances in knowledge, instrumentation, and communications technology that have transformed science dramatically in recent years. Scientific information is growing explosively while the technology used to conduct research is becoming more complicated and expensive.

Educators, scientific organizations, and parents have become concerned that failure to present the full breadth and flavor of science to young students may lead to disinterest and neglect of skills important to future careers. Such concerns have prompted reforms that integrate hands-on, inquiry-based learning experiences into the curriculum. Individual researchers have contributed to these reforms and are actively involved in creative educational outreach activities. Many scientific and governmental organizations now provide resources and financial assistance for such efforts, including the American Association for the Advancement of Science, the National Science Foundation, the U.S. Department of Agriculture (USDA), and the U.S. Department of Education. Activities of the Entomological Society of America include Insect Expo, the Formal Conferences on Teaching at the Annual Meeting, and the *BeesWax* newsletter.

This report describes some recent educational outreach activities by volunteers at the USDA Agricultural Research Service (ARS) laboratories in Florida that have received

highly positive responses from the public. Many of the activities discussed here were developed or conducted with the assistance of SCIENCE (Scientists Cooperating in Enhancing and Nurturing Children's Education), a steering committee consisting of individuals from the ARS laboratories in Gainesville (the Gainesville ARS location). We hope that the examples summarized here will stimulate further outreach efforts by entomologists.

The SCIENCE Program

Florida ARS personnel have a strong record of educational outreach efforts. To promote and coordinate these activities more effectively, staff at the Gainesville ARS location (the Insect Attractants, Behavior, and Basic Biology Research Laboratory [IAB-BBRL]; the Medical and Veterinary Entomology Research Laboratory [MAVERL]; and the Crop Genetic and Environmental Research Unit [CGERU]) formed an informal steering committee, SCIENCE, in 1991. The committee's five goals were: (1) to enhance science programs in schools by utilizing the services of the professional scientific community; (2) to stimulate students and teachers in the study of scientific concepts; (3) to encourage the pursuit of careers in agriculture; (4) to participate actively in public awareness programs; and (5) to support Equal Employment Opportunity (EEO) initiatives. Independent activities still occur at each laboratory, but many of our outreach efforts are now assisted in some fashion by the SCIENCE committee. The committee serves as an arena for communication and exchange of resources between Gainesville ARS location scientists and external organizations, such as the University of Florida (UF), the Florida Entomological Society (FES), the Alachua County school system, and school advisory groups. Subcommittees have been organized to focus on specific aspects of educational outreach, including equipment, video, and reference resources; science fairs; career fairs; EEO; laboratory tours; and teacher outreach. Informal discussions and meetings by committee members help to ensure continuity and coordinate the scheduling of different activities.

SCIENCE Program Projects

Each September, the SCIENCE committee selects target projects that will be a major focus of effort for the school year. Volunteer coordinators organize the projects, oversee activities, and solicit feedback for project improvements.

Projects conducted annually include student training, teacher outreach, science fair support, career fairs, laboratory tours, and classroom visits (Table 1).

One of the projects recently initiated by the committee was the promotion of agricultural science at local career fairs. During 1994 and 1995, ARS volunteers participated in two county-wide career fairs for high school juniors and two school fairs for middle school students. Two lectures on careers in agricultural science were presented in programs organized by the Florida Foundation for Future Scientists. The scope of modern agricultural and entomological science was a surprise to many students.

The SCIENCE committee activities that have received the most positive feedback and served the greatest numbers of individuals have been those associated with the science fair support and teacher outreach projects. Part of their success has come from incorporation of advice provided by user feedback. We consider such activities below in additional detail.

Science Fair Support. ARS volunteers participate in Science and Engineering Fairs by furnishing awards, judging, mentoring, and conducting workshops. Committee members are often category judges at school, regional, and state fairs. In 1994 and 1995, SCIENCE committee members teamed with ARS scientists from Orlando to present special agricultural awards at the State Science and Engineering Fair. Workshops for teachers, students, and parents, conducted at schools and ARS laboratories, have helped to improve the quality of science fair student projects. In these workshops, we have emphasized that the goal of science fairs is to encourage the development of skills in independent investigation. Many students and teachers have difficulty distinguishing between a demonstration and a true science project.

Teacher Outreach. The ARS laboratories in Gainesville also provide research opportunities for science teachers, including summer employment, continuing education credit, and workshops for enhancing science education in schools. Because many of the scientists have adjunct positions at the University of Florida, teachers may earn up to six college credit hours from summer research, either as undergraduate credit directed toward recertification requirements or as graduate credit applied toward a graduate degree.

Gainesville ARS location scientists have cooperated with the University of Florida for four years in the Teacher Research Update Experience (TRUE), a grant-funded program

to provide educational enrichment and laboratory training for middle and high school science and mathematics teachers. To sponsor teachers, researchers provide short descriptions of their projects and the required knowledge and skills to an advisory committee of the UF Center for Precollegiate Education and Training. The Center recruits applicants from within Florida by word-of-mouth and through brochures distributed through the science and mathematics departments of the public school systems. The advisory committee screens the applications. Successful applicants (funding is usually available for about 20 teachers) are assigned to a particular sponsor's laboratory by matching the applicant's interests and skills with the project description. Five recent projects in which teachers have participated include: (1) the interaction of plants, insect herbivores and insect parasitoids; (2) the computer modeling of dengue fever outbreaks; (3) the development of vectors for gene transfer in moths; (4) the physiological regulation of sex pheromone production; and (5) the acoustical detection of insects feeding internally in stored grain. It sometimes is difficult to subdivide part of a long-term research project into a six-week study with a well defined beginning and end, but we have received highly positive responses from teachers who successfully completed such studies. This program has the potential to benefit about 150 students for each teacher.

The SCIENCE committee also holds workshops that provide research information, references, and educational materials for developing new teaching components. These workshops are

Table 1. Scope of SCIENCE committee activities and approximate no. of people served per year since 1991

Activity	No.
Student Training (High School and Undergraduate)	
Minority-Student Summer Apprentices ^{a,b,c}	6
Student Science Training Program ^b	2
Teacher Outreach	
Teacher Research Update Experience ^b	6
Teacher Research Fellowships ^a	1
Continuing education	1
Science education workshops	15
Science Fair	
Judging and mentoring, awards	300
Workshops for project development	40
Career fairs and presentations	100
Laboratory tours and classroom presentations	200

^aFunding through USDA-ARS.

^bFunding through University of Florida.

^cFunding through Alachua County School Board.

the results of suggestions from teachers in previous years who had been asked what improvements could be made for the following year. Entomological materials make up a large part of the component and lesson plans.

Some curriculum components that teachers have sent back to us are very creative. A middle school biology teacher, for example, sent us a component that assigned students the task of comparing their jumping abilities with grasshoppers in relation to weight, height, and other factors.

User Feedback. To help improve the quality of outreach activities, the SCIENCE committee has developed several informal mechanisms to obtain responses from program participants. These include personal and telephone contacts, exit interviews and questionnaires, and follow-up questionnaires. Suggestions from students, for example, led to the organization of luncheons and tours where program participants could interact with each other and learn more about ARS research in other areas.

Questionnaire responses from teachers in the TRUE and the ARS Teacher Research Fellowship programs led to the organization of training workshops and to the development of Internet contacts for long-distance communication among scientists, teachers, and students. Few teachers and students have access to Internet at this time, but accessibility is increasing rapidly.

The many return visits we have received from participants in the student summer employment programs attest to the success of such programs in helping prepare students for college and later careers. One student obtained a degree in electrical engineering and joined the technical staff at IABBBRL. Others, 10–15 in all, have attended the University of Florida or Santa Fe Community College and have worked part-time at the ARS laboratories.

Outreach Activities at Other Florida Locations

A recent survey of ARS locations in Florida reveals interactions with a wide range of groups and organizations, including individual schools, county school systems and boards, and regional consortiums; state-level programs such as the USDA Agriculture in the Classroom Program and Cooperative Extension Services; college and university groups such as the Florida Foundation for Future Scientists, the Interdisciplinary Center for Biotechnology Research, the Florida Institute for Food and Agricultural Sciences, and the UF Department of Entomology;

and industry or professional groups such as the Florida Farm Bureau, the Cattlemen's Association, the Orlando Science Center, and the Florida Entomological Society. A particularly innovative program is an annual Molecular Biology Workshop developed by cooperative efforts of the ARS Horticultural Research Laboratory in Orlando, FL, the Orlando Science Center, and the UF Interdisciplinary Center for Biotechnology Research. The workshop involves middle school students and teachers from five central Florida counties. The participants have an opportunity to continue these studies through mentoring programs.

Concluding Remarks

Our experience as SCIENCE committee volunteers is that organized, multifaceted science educational support has considerable impact on students' and teachers' perspectives of science. The efficient use of available resources by an organized network of volunteers enhances the visibility of researchers, reduces the time involvement, and maximizes the benefits of voluntary efforts.

An institution-wide steering committee helps create a focal point for inquiries and a natural interconnection between target activities and target groups. A recent example of such interconnections comes from the summer 1995 TRUE program. A teacher who had conducted a research project with a scientist at the IABBBRL brought a class of science students back for a tour in October. One or more of these students may participate with a Gainesville ARS location scientist in a future Student Science Training Program.

With slight modifications, many activities, such as tours and lectures, can provide science information to all ages of students, elementary through college. Different activities carried out under a particular project, for example, holding Science Fair workshops for students, teachers, and parents, and mentoring student projects, can stimulate low or average achieving students and enhance the education of honor students. Additionally, educators at levels from class instructor to science department chair and guidance counselor benefit from interactions with active researchers.

A program such as SCIENCE provides opportunities for researchers to participate in outreach activities by whatever means is most comfortable to them. Nevertheless, any program like this is successful only to the extent that its participants support educational outreach individually with their time and creative efforts.

It is important that researchers continue, and even expand, their educational outreach activities, even though economic market forces may preclude all but a few students from entering research careers. The fostering of curiosity and critical thinking, useful for both the laboratory and everyday living, may be the most important long-term benefit of science educational outreach efforts.

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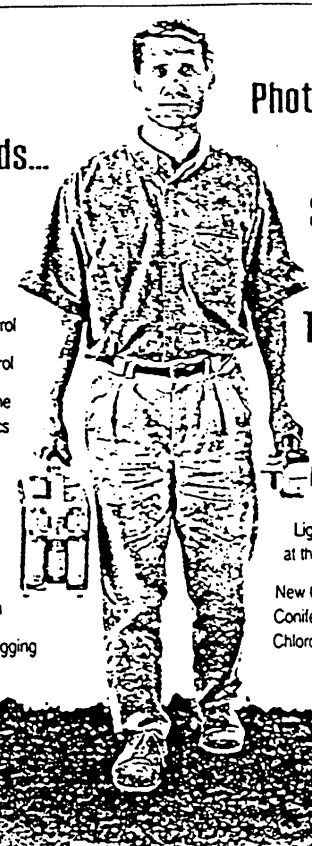
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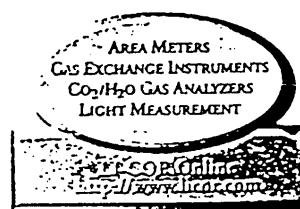
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